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THE CONQUEST OF THE DESERT

AN ILLUSTRATED DESCRIPTION
OF IRRIGATION IN THE
WEST AND ITS RESULTS

KNAUTH, NACHOD & KÜHNE

New York — BANKERS — Leipzig



COURTESY OF WORLD'S WORK

Government Shoshone dam in Wyoming, compared with the Flatiron Building. This will be the highest masonry dam in the world, 328½ feet.

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WHAT Irrigation is and
how the water is con-
ducted to the farm.

THE wealth that it pro-
duces as told by the
United States Government
figures.

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HOW bonds are issued,
safely secured by the
water and land producing
this wealth.

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Acknowledgment is made to the officials of the United States Department of Agriculture and the Reclamation Service to whom we are indebted for the crop figures and pictures herein.

What Irrigation is and How the Water is Conducted to the Farm



ERODOTUS, the father of history, upon his return from a journey to Egypt about the year 450 B. C., feared to tell the entire truth about the marvelous crops he saw growing there, lest his reputation for veracity should suffer. The same timidity comes to one who sets out to tell what has been and is being accomplished by the irrigation of the arid regions of the United States. He has, however, one advantage over the Greek historian; to-day it is possible to get exact information on the subject, and this must be his encouragement when he seeks to draw attention to one of the greatest economic undertakings of all time, ancient or modern.

The institution of irrigation itself is so old that when the United States Government, some fifteen years ago, began to pay serious concern to the matter and to ask the interest of private citizens, it had the experience of three thousand years and more upon which to rely for the economic soundness of the project. Indeed, the pioneers of American irrigation might have turned back to consult the agricultural history of the ancient Chinese, the Babylonians, the Assyrians or the Persians.

But enough of antiquity. Let us return to the present and travel out into that great land of mystery in the Far West, which, as a desert claimed the lives of numberless Argonauts of 1849 and a generation later gave the engineers of the trans-continental railroads the stiffest problems up to that time presented in the vast work of developing the transportation facilities of the United

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The original source of the water.

States. Bare and silent was this country, its background snow clad mountain peaks, its dividing lines deep-canyoned rivers and its vegetation the cactus and the sage brush.

Briefly stated, the problem of irrigation in the United States has been the utilization of the moisture that nature has supplied so abundantly to the mountains, for the enrichment of the arid plains and valleys to which nature neglected to provide this great essential of all life.

In this little book we are going to see how it has been accomplished, what some of the results have been for the country reclaimed, and how it has become possible for all those who have an abiding faith in the future of the United States to have a share in the work, with safety to their funds invested and a return that is in a measure commensurate with the important economic service which they are rendering.

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What this service is, can be summed up in a single statement of facts as ascertained by Mr. C. J. Blanchard, statistician of the United States Reclamation Service. It appears that by the expenditure of approximately \$120,000,000 in the work of irrigation thus far, there has been reclaimed an area, formerly desert, containing millions of acres of cultivated land which is now producing crops worth \$250,000,000 a year.

Reclamation has been going on in a group of States that includes Montana, Wyoming, Colorado, Utah, Nevada, Arizona, New Mexico, Western Texas, Eastern Washington, Eastern Oregon, Idaho and Southern California. In most of this territory the aridity is produced by a common cause. From off the Pacific Ocean come the prevailing westerly winds warmed by the Japan current and laden with moisture. Passing easterly over the California coast, they reach the nearer mountain ranges and are forced upward. Condensing their moisture as they cool, they precipitate



Storage Reservoir.

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it on the mountains of the coast range and then pass, high and dry, over the thirsty country that lies to the eastward.

Thus was made the vast desert embracing a large part of the entire territory of the United States. To-day, by the expenditure of the millions that the government is devoting to the work, and of millions more contributed by private investors, the desert is being reclaimed and made to yield more abundantly even than the rich lands of the Mississippi Valley.

Given the primary sources of the water supply in the mountain snows and the rivers they created, two methods of irrigation presented themselves to the students of the problem. One was to pump water from the rivers far below the level of the surrounding country; the other was to store the water back near the mountains at an elevation considerably above that of any of the territory to be reclaimed, and to feed it down by gravity to the lands selected for irrigation. There have been some very successful irrigation projects organized on the pumping basis, but in the majority of instances, the gravity system has been found better adapted to



Reservoir Dam, Headgate and beginning of Main Canal.

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Main Canal.

the conditions. The photographs which are reproduced herewith, illustrate the handling of the water on the gravity system from the time it leaves the mountains until it is led out onto the farms.

There is a great variety of problems to be solved in the construction of an irrigation system, which call for all the skill and expert knowledge of modern engineering science. The question of determining the flow and regulating the volume of water is one of utmost importance. For example, we may suppose that there is a river with a reasonably constant volume of water which has its beginnings in a mountain stream and gradually finds a more peaceful way oceanward through the arid country. The fundamental difficulty to the farmer along its banks is that the river lies so far below the level of the lands on either side that its waters are not available for irrigation, except by the process of pumping, which is too costly for any individual or small group of individuals to undertake unaided.

This is where the irrigation engineer makes his entry. His first inquiry is to determine the highest point of the land which it is practicable to supply from the head waters of the river and this involves the accurate determination of the flow and the volume of water which may be reasonably counted upon.

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A Lateral Ditch branching from Main Canal.

It is, of course, quite as important that there shall be a proper conservation and distribution of water below the main reservoir in the system of canals, as in the reservoir itself. To this end the main canals are supplied with a system of water gates, or locks, as the case may be, which bring the flow under absolute control. Two of the pictures illustrate how this is done.

✕ Comes now the canal itself, threading its way through the fields and past the new found homes of the desert reclaimed. The canal has a gentle and even flow which is regulated at the head-gates far away, and as it passes from district to district, it distributes from its water wealth to its tributaries.

All the concomitants of irrigation are subject to the varying conditions of the regions to be reclaimed. The problem of water storage itself has an infinite variety of phases. In some districts it is comparatively simple; in others, it tests every talent the engineers possess. There are storage dams in California which were constructed by blasting the rock down off the sides of a

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canyon in the first instance and then filling in the interstices with some substance impervious to water and supporting the base by steel plates or concrete. Dams of earth and timber combined have been used quite extensively in some regions, while in others are found huge masonry structures, sometimes of seemingly impossible height and length.

An example of the masonry dam last mentioned is found in the great Shoshone Project of the United States Government, the height of which is illustrated in our frontispiece. It will be 328½ feet high, being the highest masonry dam in the world.

But to return to the process of irrigation as we have traced it from the snow clad mountains to the farm where the crops are grown. It is not enough to bring the water to the farm, as might be done in a country where the natural precipitation does some part of its share of the work of production. The soil must be flooded; water enough must be led into every foot of ground under cultivation, to make up what nature has denied. Therefore we come next to the system of farm ditches or laterals, which take the water off from the district canal and bring it where the crops are actually produced.

Here the farmer becomes an essential factor in the scheme of economy that underlies the whole system of irrigation. He



How the Water Level is lowered to retard the flow.

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must have his own head gate where his private ditch or farm lateral takes off from the district canal. With this he is to control the flow, both for his own account and for that of the users below him. The irrigated States, through their appropriate officers, keep a close watch upon this, as upon many other phases of their irrigation enterprises. Nearly, if not quite all of them have an official known as a "Water Master" who is largely concerned with enforcing an equitable and economic use of the water supplied by the irrigation canals.

There is a careless saying that irrigation is the lazy man's way of cultivating. The farmers and scientists who have made a practical study of the subject, know that the reverse is the case; every crop has its own peculiar requirement and every varying soil its personal behavior as regards the receipt and transmission of water. The farmer's needs of water are going to vary as the seasons succeed each other and the crops advance, and too much



Another drop, lower down.

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The arrival of the Water at the Farm.

moisture at some times will be quite as fatal to his yield as too little at others. Another factor of prime importance is the provision for the nitrogenous organisms which contribute under proper treatment of air and water, the nourishment for the vegetation. Too little water leaves them dry and useless; too much stagnates and destroys them. So the farmer has his problems, like the engineer, and to their solution the National Government with its experimental stations, the States, the railroads, and many private interests are turning the best attention that can be given and circulating the results of all this work over the whole irrigated country. When, therefore, the time comes to put the stream to the actual work for which it has been carried so far, the man who completes the chain of human factors, and who stands, also, to reap the largest benefit, knows how it may be applied to the best advantage for whatever crop he is to raise. He may do his flooding by means of low banked sub-laterals which allow the water

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Sometimes a Farmer uses a Wooden Gutter to distribute his flow.



"Wild Flooding," used in growing Alfalfa.

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from the main farm lateral to overflow their sides, or he may water by higher banked and narrow ditches which let just enough of the flow in between the furrows where the crops are planted to keep them constantly supplied with the life-giving moisture without washing away the soil. Or again he may seek "wild flooding," if he is raising hay or alfalfa, and construct from the upper end of his field a system of "checks" or furrows, spreading out like the branches of a tree and ending nowhere. This will give him a thin and even distribution of his water over the entire area to be cultivated. And finally, if he is undertaking to raise orchards or vineyards, he may conduct his supply from his farm ditch across the orchard and back again, in a lined box with frequent little gates along its sides, from which the water may be fed to the several rows of trees.



Irrigating Lettuce.

The Wealth that it Produces as Told by the United States Government Figures



WE have now followed the course of the water from its origin in the melting snows of the mountains, down through their narrow gorges into the storage reservoir built to contain it; thence out by way of the great head gates into the main canal, and on into the district canals, until at length it reaches the farm, to be distributed as best will serve the needs of the desired crop. So much the farmer has had done for him; to this extent he may draw upon the skill and energy of others. His own responsibility consists in assuming the easy obligations which will eventually result in the repayment of the capital advanced to establish his irrigation system and will leave him with a permanent supply of water free as the air he breathes, save for the insignificant annual payment for the maintenance of the plant. It is now for him to prepare his land, to plant and cultivate his crop and to gather in his harvest.

Uninviting enough is the prospect that he beholds when he comes first to take up his land. The garment of the desert is the sage brush or the cactus. Its guide posts are the whitening skeletons of the creatures that in years gone by sought there to find the means of subsistence and left their bones to tell to later comers the story of their failure. But the farmer who obtains land in any of the irrigated regions to-day has before his eyes an encouraging spectacle that could appear only as a treacherous mirage to any of his predecessors, men or beasts. He can

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look across from his barren tract to the land of his neighbor, who has preceded him, perhaps, by only a few months or a year. There he sees, almost as a miracle, the orchard, or a succession of long, even furrows topped by some growing crop, or the field of grain that is to make food for a thousand in some distant city. It may be the waving grass and the luxuriant alfalfa that attracts his glance and tells him that here in the reclaimed desert is the forage for herds of cattle. Most eagerly he goes to work on his own section, impatient for the day when it, too, will be producing its quota toward the country's wealth. Fortunately he does not have long to wait.

There is a most fascinating history behind this conquest of the desert. To catch its outline one must take his mind back over the period following the Civil War when the vast fertile regions of the Mississippi Valley were opened up to large scale production



Desert before and after reclaiming—Homestead in the distance.

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Clearing and Burning the Sage Brush.

by the development of the country's transportation systems. Farther and farther out onto the prairies pushed the railroads, and as they progressed enveloping the land with a net work of branches, civilization followed in their wake. The Indians and the buffalo were driven back in the then border States by the grazer with his cattle; the farmer followed hard after, as the development of agricultural machinery and the improvement of railroad facilities gave to American energy an ever-widening field for its profitable employment. By and by there came a time when the Indians and the buffalo were memories of bygone age, when the great plains were made to yield an abundant food supply for men, instead of beasts. And finally, toward the end of the last century, the nation approached the day when it must look for still newer sources of its food supply. The arable lands in the regions of settled rainfall were practically all in use.

The problem thus presented was one of National importance. It took no more than a casual examination of the statistics to demonstrate that the population was increasing faster than the apparent ability of the country to feed it, and that if the existing conditions were allowed to work out their logical result, it would be a comparatively short time in the life of the Nation when the United States would be calling upon the other countries of the world to help support its people. The farm regions of the Mississippi, the prairies that border the Missouri River, the States

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of Kansas, Nebraska, Texas and the Dakotas all were taken up and there was little or no public land anywhere in the central section of the continent available for productive development.

To all this there could be but one answer: Go West! Reclaim the desert from the cactus and the sage brush, water it and make it, too, contribute to National harvest! How well the answer has been given and the new responsibilities assumed is told in the story of the irrigation projects that now are dotted all over the map from the easterly slope of the Rockies clear out to the Pacific coast. The production of crops in any one of the areas where irrigation has been undertaken on a scientific basis and financed wisely, is a marvel to one who has been accustomed to the slower processes of agriculture in the older parts of the country. Hardly is the sage brush removed from the land, the plowing done and the water turned on, when all seems to start with a new life.



Gathering in Alfalfa.

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It is no matter of years, but one of months only when the farmer's dream begins to find its realization. The crops of his first year will replenish his treasury so that he may enter upon his second inspired by the knowledge that his hopes have come true, for, under the terms that have been almost universally adopted where large scale irrigation projects are being operated, the payments for water service are so pro rated that they do not involve an initial outlay of capital that is beyond modest means. Thus the chief item of expense becomes that of labor and subsistence until the first crops are harvested and sold. It involves no exaggeration to tell of a crop of hay or alfalfa well under way within three months after the sage brush has been cleared off the desert land.

What then are the concrete results of this irrigation farming whose actual operation we have traced thus far and a sketch of whose history in this country we have endeavored to present?

The United States Government has for many years kept detailed records of the actual acreage, crop production, and farm value of practically all of the agricultural products in each of the States. The statistics are complete and definite and the tremendous service rendered by irrigation may be readily understood



150 tons of Alfalfa raised on 32 acres of land.

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Stacking Alfalfa.

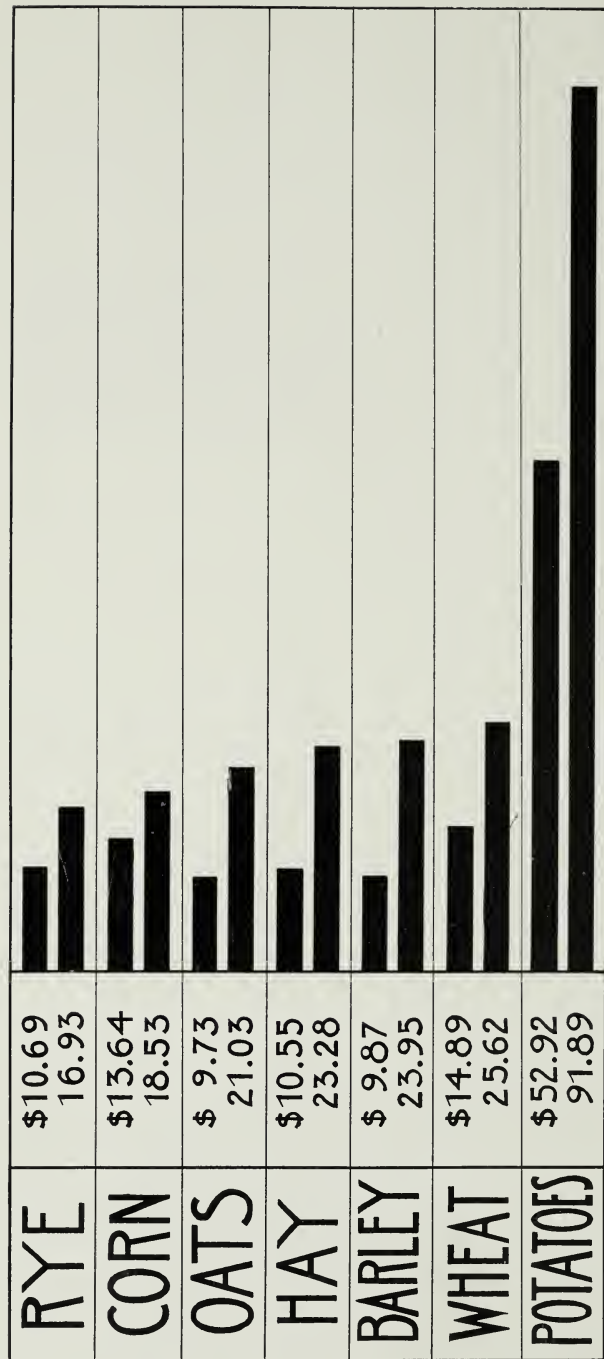
from Government figures like the following, which show acreage, the value of farm product and the yield in dollars per acre in four long cultivated non-irrigated States and in five irrigated States for the year 1909:

Non-Irrigated States.

	Acreage	Farm Value of Product	Farm Value of Product per Acre
Iowa	18,280,000	\$244,741,000.	\$13.38
Missouri	13,593,000	200,265,000.	14.73
Kansas	16,989,000	203,280,000.	11.96
Nebraska	14,793,000	183,661,000.	12.41
Total	63,655,000	\$831,947,000.	\$13.06

Irrigated States.

	Acreage	Farm Value of Product	Farm Value of Product per Acre
Montana	1,288,000	\$29,464,000.	\$22.87
Idaho.	1,269,000	32,906,000.	25.93
Colorado	1,495,000	40,449,000.	27.05
Utah	709,000	18,497,000.	26.08
Wyoming.	477,000	11,246,000.	23.57
Total	5,238,000	\$132,562,000.	\$25.30

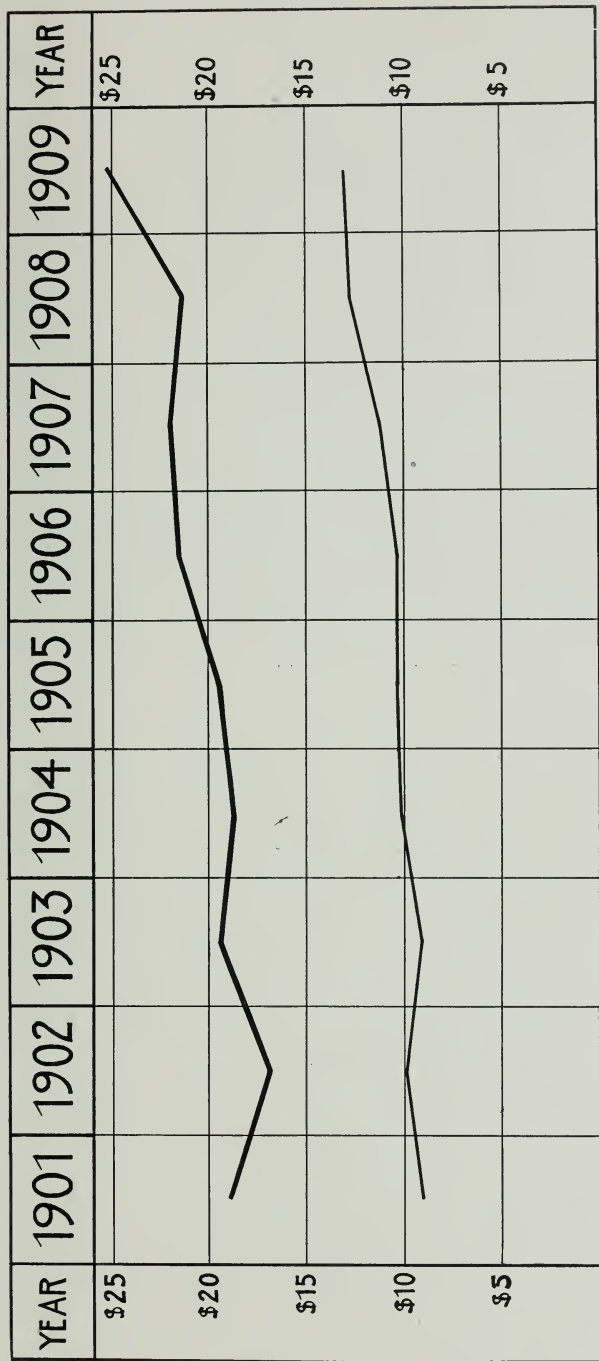


The comparative crop value per acre in each of seven staple crops.

Four non-irrigated States upper line.

Five irrigated States lower line.

These are from official figures of the United States Government for the year 1909.



Crop value per acre of seven staple crops combined.

Five irrigated States upper line.

Four non-irrigated States lower line.

These are from official figures of the United States Government for the nine years 1901-1909.

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Orchard one year old.

Even more striking does this comparison appear when one considers the chart which constitutes one of our illustrations, the two lines showing the crop value per acre of the seven staple farm products of wheat, oats, corn, rye, barley, hay and potatoes, in the same four non-irrigated States and in the five irrigated States over a series of years from 1901 to 1909, according to the government figures. The chart is worth taking note of also, in that it demonstrates that the returns now enjoyed from irrigation do not represent any chance good fortune of a season or two of exceptionally favorable climatic conditions, but are steady and constant. If one's interest prompts at this stage a little more detailed comparison of some of the individual crop yields in the same groups of States, the subjoined diagram representing the relative values per acre for each of the staples mentioned, will furnish it. Pick out any year and compare the yields, test each crop in succession and you will get the graphic contrasts.

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We find that the verdict is the same from whatever point of view we approach the discussion, irrigation has supplied the magic that has "made glad the solitary place and the desert to rejoice and blossom as the rose."

There is still another phase of irrigation which it is worth while to consider briefly before we approach the third division of our subject, and learn how it has become possible for the investor to have his part in the great work of reclaiming the desert. The dry tracts of land in the arid regions have been held in the past to have little, if any, value whatever. The fact that for many years prior to the application of the water they have lain undisturbed by the plow of the homesteader, illustrates the complete absence of utility to man. With the coming of the water there is added the essential new element of land value—the water right.



Orchard three years old.

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The cost of this varies according to the conditions that have been encountered in bringing the water to the land. Under the average conditions the farmer of staple crops will pay from \$35 to \$50 or even \$60 an acre for this water right.

Comparing, then, the highest figure on the cost of the water with the average value of farm products per acre in the irrigated States, it appears that the land returns, under the least favorable conditions, the cost of irrigation in less than three years, and in many regions, where the water right is not over \$40 an acre, returns that value to the farmer in two years. How many States are there in the older portions of the continent where a showing can be made comparable to this?

And in the end we ask the secret of it all. The experts in irrigation, men who have been studying the subject in this country over an ever-broadening field for the last fifteen years, and who



Picking Strawberries between the rows of a young orchard.

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Apple Orchard in bloom.

have drawn upon the experience of many centuries in other lands, are ready with an answer. In the first place, there is the soil itself. Dry and barren and useless though it is without the vital moisture, it contains in a high degree the soluble salts which plant life requires for its sustenance. These salts have been storing up for ages and when the water is turned in upon the land, it is as if we had traveled back to the beginning of things and invited the earth to "bring forth grass, the herb yielding seed and the fruit tree yielding fruit." In the supposedly more favored territory, where the rainfall has been regular, much of these salts have been washed out of the ground and the food supply for plant life of every kind is correspondingly more meagre. Thus it happens that in the most seemingly hopeless desert, where the natural conditions forbid even man to enter save at the peril of his life, irrigation works its greatest marvels.

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The irrigation farmer, also, is at a large advantage over his fellow who is dependent upon rainfall for his water. The latter becomes from time to time the victim of drought; the former, never, for his water supply is always there, ready to be turned on at his own head gate where his farm lateral takes off from the district canal. The farmer of the humid or semi-humid regions, moreover, may get his water just when he doesn't want it, and in quantities that are ruinous to his prospects for a profitable crop season. To these uncertainties the farmer who depends upon irrigation for his water is never a prey; he lives in a land of almost perpetual sunshine and not infrequently in a land of staple temperature. The warmth and good cheer of the sun he always needs for himself as well as his crops; his water supply he has quite as much under his control as if he were operating a factory in the city, where he could obtain his water by turning a stop cock, and could shut it off in the same way.



These Northwestern Apples are now the standard in the Eastern and European Markets.



Lambs fattening on Alfalfa pasturage.

Once more, the irrigation farmer has opportunity to study under varying conditions, the behavior of the crop that he proposes to raise, and by the knowledge so gained, can apply his water scientifically, where his co-laborer in the non-irrigated territory, having been dependent upon natural conditions, is far more likely to chance it that the grace of nature will bring him through. Finally, the irrigation farmer makes his harvest knowing that he will have ideal conditions to cure any crop that requires treatment before marketing. It is not difficult to understand under these conditions why the glowing reports come from the irrigated regions and are backed up by the government figures showing comparative crop yields by States and the values per acre which they attain. It is not difficult to understand why millions of government funds and millions more of private capital are being

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devoted to irrigation enterprises over the entire far-Western country from the Canadian border to the Mexican boundary, and even beyond both of those lines into our neighbor countries. In this rapidly developing garden belt of the continent is to be raised the new food supply which will keep the American people for many years to come from looking to other lands for the staples that they consume. The importance of the movement viewed from its effect upon the balance of trade alone is worthy the attention of every citizen of inquiring and serious mind. Let us, then, take the next step and examine with such care as is possible within the limits of this writing, the legal and financial conditions with which the irrigation proposition has been surrounded, so as to be able to judge whether immediate self-interest, which must be controlling with the man of means, justifies his consideration of irrigation bonds as a safe form of investment.



How Bonds are Issued, Safely Secured by the Water and Land Producing this Wealth



HERE is an interesting parallel between the economic and the legal sides of the irrigation problem. In studying the first, we find that the underlying condition is the physical union of the water and the land. So in examining the second it appears that throughout the irrigated territory the old doctrine of riparian rights has undergone substantial modification, to the end that the economic benefit of the water shall be preserved for the entire area under irrigation throughout all the years to come, the water and the land being legally and inseparably linked. The National government has builded upon this principle wherever it has entered as a factor in the situation; the irrigation States all recognize it in their laws, and private corporations devoting themselves to irrigation have, perforce, been guided by the National and State laws applicable.

It would involve too long and too detailed a discussion for this little book to trace fully the development of the laws relating to irrigation, which mark the collective efforts of the Nation's representatives to safeguard this vast field of human activity, and relieve it from as many as possible of the uncertainties that were encountered by those who as investors or patrons came into contact with the earlier railroad development of the country.

Briefly stated, however, the Homestead Law of 1872 and the Desert Land Law of 1877 were the forerunners of the modern

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statutes, the Carey Act and the Reclamation Act. The two first mentioned contained general provisions under which home seekers could obtain specified amounts of the public land for cultivation, at the nominal price of \$1.25 an acre. The Desert Land Law, in particular, directed attention to the vast areas in the arid States and offered extra inducements to any one bold enough to undertake their reclamation.

The passage of the Carey Act in 1894 and its subsequent amendments, grew out of the realization on the part of the government that the reclaimable area of government land in the arid States was too vast to admit of its adequate reclamation by settlers working individually or in small groups.

The Carey Act provides that the government undertake to assist the reclamation of the country's desert lands by deeding in each of the arid States up to 1,000,000 acres of land to the State



Alfalfa fattens cattle as well.

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Wheat grown on irrigated land produces a much heavier crop than elsewhere.

(since increased by amendment, to 2,000,000 acres in Idaho and Wyoming).

Some vital conditions of the Carey Act are as follows:

The State shall not sell or allot to any settler more than 160 acres of land.

The State shall cause to be irrigated, reclaimed and occupied not less than 20 acres of each 160 acre tract disposed of to settlers.

The State is "authorized to make all necessary contracts to cause the lands to be reclaimed and to induce their settlement and cultivation."

"A lien or liens is hereby authorized to be created by the State—and when created shall be valid on and against the separate legal subdivisions of land reclaimed."

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Oats tell the same story.

(This provision was inserted for the purpose of making it possible for the capital invested in an irrigation enterprise to be protected by the security of the land itself.)

Before the United States will agree to deed a particular tract to the State, the latter must file an application for same, "accompanied by a map of the said land proposed to be irrigated, which shall exhibit a plan showing the mode of the contemplated irrigation and which plan shall be sufficient to thoroughly irrigate and reclaim said land, and prepare it to raise ordinary agricultural crops, and shall also show the source of the water to be used for irrigation and reclamation."

"All information necessary to enable this office to judge of its practicability for irrigating all the land selected, must be submitted." (Quoted from Land Office regulations).

Seven States have accepted the conditions demanded by the Government statute and enacted appropriate legislation looking

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to the safe guarding of the interests of both the settler and the capital invested.

In practice the successive steps in the development of a Carey Act enterprise may be described as follows:

A company or individuals in possession of adequate water rights makes application to the State Land Board for permission to build an irrigation system, whose purpose it shall be to supply irrigation to a certain tract of government desert land. This application is accompanied by such maps and other data as have been described above. The application is referred to the State Engineer for his examination and report. If the latter is favorable and the State Land Board approves, the Land Board makes the application to the United States Government which has been described above, for the deeding to it of the tract of desert land under the provisions of the Carey Act.



Kaffir Corn—a fodder crop of great fattening value.

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If the Department of the Interior, after examination of the project and the plans submitted, approves, an agreement is entered into between the government and the State, under which the latter undertakes to supply, by contract or otherwise, the specified irrigation system, the government on its part agreeing to deed the land to the settler (through the medium of the State).

When the State receives back from Washington the executed agreement, it executes a contract with the irrigation company which made the original application, whereby the latter agrees under heavy bond, to construct irrigation works in accordance with the approved plans and under the supervision of the State Engineer.

In this agreement the State permits the irrigation company to sell a perpetual water right to a settler on the desert tract, stipulat-



Corn—note the height of the stalks and the size of the ears.

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Grapes form a most important product in certain portions of California.

ing a maximum price, and stipulating terms as to the number of installments over which the settler may be privileged to spread his payments.

It is usual to embody in this agreement an exact copy of the water-right contract to be used between the irrigation company and the settler which operates as an absolute deed to the perpetual water right upon the fulfillment of the settler's obligation. This is known as a "settler's contract" and will be referred to hereafter.

It is customary to embody in the irrigation company's contracts both with the State and with the settler, provisions which will furnish an organization by which the settlers are to manage the irrigation system when it has thus become wholly theirs.

When this time comes, that is, when the water payments are completed, the farmers have become in effect, citizens of a Muni-

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Cabbages in what was the Yuma Desert, Arizona.

cial Irrigation District and the irrigation company having been repaid its original capital invested with the profit thereon, has become a name only, its property having passed to the settlers.

Carey Act Corporation Bonds.

Thus far we have traced the practical operation of the Carey Act project and it will be noticed there has been no mention of a bond issue.

The primary purpose of an irrigation company in executing and selling an issue of bonds, mortgaging its present irrigation property and the future payments of the settlers to the trustee for the bondholders, is to realize in cash a material portion of the original cash investment in the works and the profits thereon, instead of having to wait for this realization to come in gradually in installments during the next 10 or 15 years.

The conservative practice is for the company to issue and sell bonds secured by a first mortgage on its works and to pledge all the "settler's contracts" as further collateral security with the Trustee for the bondholders, who collects each installment and interest payment direct from the settlers, applying the proceeds, as far as need be, to the payment of the principal of the next maturing series of the bonds and the interest maturing on the same date.

It is through the medium of the pledge of these "settler's contracts" that the bondholder holds the first lien upon the land and the water which is provided for in the Carey Act.

Municipal Irrigation District Bonds.

Municipal District Irrigation bonds are issued by organized districts for the purpose of purchasing, constructing, or extending irrigation systems for their own use, after approval by the vote of the resident freeholders. These bonds also are issued in separate series maturing in successive years, funds for the payment of which, with the maturing interest, is furnished through an annual tax levied in the regular way and usually in an amount about 15 per cent. in excess of requirements. The tax is collected



Potatoes in Nevada.

THE CONQUEST OF THE DESERT

and the principal and interest of the bonds are paid through the County Treasurer's Office.

This annual tax is analogous to the annual payments made by the settler to the trustee in the case of the Carey Act bonds, and under the law the bonds are protected by a first lien upon the property, as in the case of the Carey Act bonds.

Corporation Bonds on Lands in Private Ownership.

In this class of bonds the issuing company has acquired a large tract of land and a sufficient water site and supply for the irrigation of the land, making its profits on the sale of the lands to settlers at the much higher prices made possible by the construction of the irrigation system. In this case the price of the land, with its accompanying water right, is a matter of contract between the company and the settler, the State having nothing to do with



A field of Sweet Potatoes.

THE CONQUEST OF THE DESERT



Sugar Beets—from the field to the mill.

this. The bond issue is secured by a first mortgage on the whole irrigation system, water supply, reservoir, canals and irrigable lands owned. As the land with the accompanying water right under the pledge of the mortgage is sold, parcel by parcel, the lien given by the irrigation company in favor of the bondholders is customarily replaced by a first mortgage executed by the purchaser upon his newly acquired land and accompanying water right, this mortgage being lodged with the trust company acting as trustee for the bondholders and being in an amount per acre at least equal to that of the lien in the beginning. For example—suppose an irrigation company executes a bond issue which is limited by the terms of the mortgage to \$40 per acre of the irrigable land which it owns. As it sells each tract of land, the trustee accepts for the bondholders a new mortgage executed to it by the purchaser, for not less than \$40 per acre and usually more, in place of the original lien granted by the irrigation company. These individual mortgages pledged with the trustee are similar in effect to the “settler’s contracts” pledged under a Carey Act issue.

To sum up, the bond in which the investor may be invited to place his funds will fall into one of the three classes described above, which have in common the following vital features:

THE CONQUEST OF THE DESERT

First—Their issuance and sale furnishes the means of supplying water now flowing to waste during the non-growing season to land now desert and otherwise worthless, producing through the application of the water just when needed, crops far greater in volume and value than those grown anywhere by natural rainfall.

Second—The bonds mature serially, the last series ordinarily not being over fifteen years.

Third—The settler acquires an absolute and perpetual right to a sufficient supply of water to irrigate his land, paying for same by easy installments corresponding generally in maturities to those of the bond issue.

Fourth—The bonds are secured by a first lien both upon the land irrigated and its water supply until the bonds are paid off.

Fifth—In all three classes the land and water when once wedded are inseparable.



Irrigated fruit farming sometimes produces picturesque views.

THE CONQUEST OF THE DESERT



An irrigated valley.

Sixth—The rate of interest has been in nearly all cases 6 per cent.

This writing would be incomplete without some further mention of the United States Government Reclamation Act passed in 1902, under the provisions of which the government is devoting the receipts of the sale of the public land of sixteen States and territories in the arid and semi-arid region to the survey and construction of irrigation works needed for reclamation.

This has resulted in the complete or partial construction of some thirty separate projects, under the supervision of the government engineers, and which have already produced remarkable results in increasing the agricultural wealth of the Far West—results which are becoming more striking with each year.

The provisions of the Reclamation Law with the regulations adopted by the department to supplement it, contain certain

THE CONQUEST OF THE DESERT

marked analogies to those in the Carey Act. A settler must prove his good faith by actually residing on the land. He shall not take up more than 160 acres nor less than 40 acres, and must cultivate his tract to the extent decreed by the law. The cost of the irrigation works under which he is farming is pro rated upon the actual acreage of each farmer, and he is allowed the privilege of paying for his water right in annual installments.

“When the payments required by this Act are made for the major portion of the lands irrigated from the waters of any of the works herein provided for, then the management and operation of such irrigation works shall pass to the owners of the lands irrigated thereby.”

We see in the above, recognition of the same broad principles found in the Carey Act, both statutes looking to the withdrawal of the corporation's or the government's activities, as the case may be, these being replaced by the control of the community itself.

Owing to the very fact that the settlers are given a considerable term of years (not to exceed ten) in which to complete their payments, the government has found itself with a large amount of incomplete work on hand in various projects, with the available money in the reclamation fund virtually exhausted, and therefore without means to carry out its comprehensive plans. It appears that this situation will shortly be remedied by the authorization by Congress of an issue of some \$30,000,000 United States Reclamation 3 per cent. bonds or certificates to provide the necessary funds, such an issue having been recommended by the President of the United States and a bill for the purpose having been introduced into Congress. It is interesting to note that this bill provides for the redemption of the bonds out of the settlers' payments for their water rights, the method already in force in the case of irrigation bonds generally.

THE CONQUEST OF THE DESERT

Such, then, are Irrigation Bonds. They may be recommended to investors as a safe and unusually attractive form of security, provided adequate inquiry has been made to ascertain the character of the enterprise against which they are issued, in its physical, financial and personal aspects. After all that has been said in the foregoing pages it is needless at this point to remark upon the necessity of having an irrigation enterprise located where there is an adequate and constant water supply, or constructed by competent engineers, or wisely given over to agriculture or properly financed. Nor is more than a general reminder required that the investor must consider, if he satisfies himself on these points, whether the terms of the mortgage that secures his bonds adequately protect his interests. These are matters upon which his bankers can advise him, the bankers, in turn, having had detailed investigation made of the irrigation projects on their own account, and having availed themselves of the best legal and technical advice. Of course it is open to the individual investor, if he has nothing else to do, to seek for himself these first hand sources of information; but if he belongs to the larger class who are willing to avail themselves of the economic facilities of modern business, he will investigate his prospective purchase through the eyes and ears of the men expert in the particular question that is involved. The results of the work of all these are available for his enlightenment.

PRINCIPAL CORRESPONDENTS

Deutsche Bank, Berlin.

Dresdner Bank, Berlin.

Pariss Bank (Limited), London.

Crédit Lyonnais, Paris.

Banca Nacional de Mexico, Mexico City, Mex.

First National Bank, Chicago.

Philadelphia National Bank, Philadelphia.

First National Bank, Boston.

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SIX PER CENT. CAREY ACT BONDS AT PAR

Secured on fertile land and on an Irrigation System approved by the
United States Government.

Following are details of the issue:

\$1,500,000

First Mortgage 6% Bonds

OF THE

CONRAD LAND AND WATER COMPANY

Teton County, Montana

THE AMERICAN TRUST & SAVINGS BANK, CHICAGO, TRUSTEE

Dated December 17, 1909. Principal and semi-annual interest payable January 1st and July 1st, at The American Trust & Savings Bank, Chicago, or at the Guaranty Trust Company, New York, at the option of the holder. Denominations:—\$1,000, \$500 and \$100.

Bonds maturing January 1, 1915, are all in \$100 denomination.

Maturing serially as follows:

\$ 62,500 January 1, 1912	\$125,000 January 1, 1918
62,500 January 1, 1913	125,000 January 1, 1919
112,500 January 1, 1914	125,000 January 1, 1920
125,000 January 1, 1915	125,000 January 1, 1921
125,000 January 1, 1916	125,000 January 1, 1922
125,000 January 1, 1917	125,000 January 1, 1923
\$137,500 January 1, 1924.	

Bonds maturing January 1, 1918, and thereafter, are callable at 105 and interest on January 1, 1911, or on any interest date thereafter before maturity, on 60 days' notice.

UNDER STATE SUPERVISION

These bonds are issued by the Conrad Land & Water Company in compliance with the Act of Congress known as the Carey Act. The Company has complied with the provisions of this Act, and has the approval of the State Engineer of Montana on the plans and specifications for the construction of the works, as well as his approval of the water supply. The Trust Deed securing these bonds is approved by the Attorney-General of the State of Montana.

SECURITY

These bonds have a first mortgage lien on all of the property owned by the Company, consisting of:

Valuable water rights entitling the Company to first storage appropriations for 275,000 acre ft. of water per annum.

All Rights of Way, Canals and Reservoirs, including Lake Frances, 18 miles in circumference, having a storage capacity of 170,000 ac. ft.

Laughlin and Dry Fork Reservoirs (not yet completed) estimated to have a combined storage capacity of 70,000 ac. ft.

Giving a total storage capacity of 240,000 ac. ft.

ADDITIONAL SECURITY IN HANDS OF TRUSTEE

Under the terms of the contract with the State of Montana, the Company is authorized to sell a perpetual water right to a settler for \$40. per acre, \$3. payable in cash and the balance in fourteen annual installments, carrying 6% interest. These contracts by authority of the United States Carey Act and the law of Montana, will carry a first lien upon the settlers' land and accompanying water right. Similar contracts may also be made with the settlers on lands within the district which are not included in the Carey Act segregation. The contracts are assigned and deposited with the Trustee, The American Trust & Savings Bank of Chicago. The bondholder thus has a lien on the land as well as the water. The completion of the payments vests in the settler a pro rata ownership in the irrigation system, including the reservoirs and canals.

As the Trust Deed limits the bonded debt to an amount not exceeding \$25.00 an acre, there are at the date of issue \$37.00 of contract liens or first mortgages deposited with the Trustee for each \$25.00 of bonds outstanding — more than \$140.00 of liens to \$100.00 of bonds. The Trust Deed also provides that this ratio shall be maintained during the life of the bonds. As this farm land has an earning capacity of \$20.00 to \$40.00 per acre per annum when irrigated, a conservative estimate places its value at from \$75.00 to \$100.00 per acre; thus the security is several times the amount of the bonded indebtedness.

LOCATION

The Conrad Land & Water Company Irrigation district is located in Teton County, Montana, just east of the main range of the Rocky Mountains. Locally the district is designated as being in the "Chinook Belt", the warm currents of air caused by the Japan current in the Pacific Ocean moderating the temperature so that for fifteen years the Government Weather Bureau shows the average growing season of this district — the period of the year absolutely free from frost — corresponds with the growing season of Sioux City, Iowa, in the great corn belt.

WATER SUPPLY

Birch and Dupuyer Creeks have their source in the main range of the Rocky Mountains, 40 miles West of Valier. This heavily timbered section is known as the Lewis & Clark National Forest Reserve. Birch Creek is the larger of these two streams and compares in size with the Shenandoah River in Virginia, or the Desplaines River in Illinois. The combined supply from both is estimated at 275,000 acre feet. The Company has the first storage rights to this water, thus insuring an ample supply to irrigate the tract. The amount of water necessary to irrigate this land has been found to be equal to 18 inches in depth over the irrigated surface.

THE LAND

According to the plans approved by the State Engineer of Montana, 160,000 acres of choice land specially adapted to general farming and dairying are irrigable from the canals and laterals, after making deductions for Rights of Way, Public Roads, Townsites, etc.; of this about 100,000 acres are Government Carey Act lands and the balance held in private ownership. A chemical analysis of the soil shows an unusually large proportion of lime, potash and nitrogen, sufficient for 124 years continuous crop of wheat on a basis of 30 bushels of wheat per acre and 81 years continuous crop of oats on a basis of 60 bushels per acre.

The topography of the district is ideal for both irrigation and drainage. No part of the area has less than four feet fall to the mile and the even contour enables the farmer to distribute water by gravity at a minimum cost for maintenance.

The United States Government through the Reclamation Service is financing several projects in the vicinity of the Conrad tract. Immediately south the Sun River project is under construction and on the north is the Milk River project.

PRODUCTS

Montana as a State records an average yield of 28 bushels of wheat per acre and has maintained this average for ten years. Under the Conrad Land & Water Company Canals the average is higher. There are four grain elevators in this tract now in operation, one a 40,000 bushels elevator at Valier just being completed. Cash wheat is 85c per bushel so that the farmer can easily pay off his entire debt of \$37.00 per acre in two years should he so desire. Oats yield 60 bushel per acre and command a premium of 3c per bushel on the Chicago Board of Trade over oats raised in the humid belt. Potatoes correspond liberally to irrigation in this district and exceed the average yield of potatoes in the State of Montana which is 176 bushels per acre. One State only in this country has a higher average yield per acre. Sugar beets, small fruits, vegetables and alfalfa are also profitable crops.

MARKETS

This District is only 69 miles from Great Falls where the large water power (ultimate development 350,000 H. P.) is used to operate the second largest smelter in the world. Four flour mills of 2500 bushels per day capacity and other manufacturing industries, afford a constant and growing demand for all farm products. Official figures show that last year \$10,000,000 of farm and dairy supplies were imported into the State of Montana so that local markets are assured.

TOWNS AND RAILROADS

There are two thriving towns in this district, Conrad and Valier. Conrad, having a population of about 700, contributes the third largest amount of freight receipts of any town on the Great Northern Ry., in Montana. Valier starting with no population July 15, 1909, had on November 27th a population of about 400 (93 school children) a National Bank, capital \$25,000; an electric light and waterworks plant; a 40,000 bushel wheat elevator and several hotels, one of brick construction, thirty-two rooms, three stories high, supplied with hot and cold water, thoroughly modern.

Valier commands a beautiful location on the banks of Lake Frances, is the terminus of the Montana Western Ry., has a weekly paper, and the usual number of business houses found in towns of its size. The Great Northern Ry., forms the eastern boundary of this District and the Montana Western Ry., twenty miles long, has just been completed from Conrad to Valier, furnishing convenient transportation for the entire district. Since July 15th this branch line has averaged 10 carloads of freight per day.

SUMMARY OF STRONG POINTS

Mortgage liens on agricultural lands representing in value several times the amount of the bonds.
Serial payments — quick reduction of debt.
Exceptional location surrounded by irrigation sections of demonstrated value.
Economical distribution of water by gravity pressure.
Local markets afforded by Montana mining sections.
Engineer's report by the Arnold Company of Chicago.
Legal opinion by Messrs. Adams and Condee of Chicago.

PRICE:—100 AND INTEREST.

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